

Building Energy Audit & Screening Tool: Notes for WAP multifamily auditors

Scott Campbell, 3E Thermal. April 2, 2015, update March 28, 2017

1. Overview

1.1. Before you begin

1.1.1. Check for Update: 3EThermal.org/what-we-do/documents/

1.1.2. Save As new file name

1.2. Bottom of screen: Notice various **Tabs, also called "Pages" or "worksheets"**

1.2.1. DARK BLUE tabs: data entry

1.2.2. DARK RED tabs: output only

1.2.3. LIGHT BLUE "Ref" tab: shows various adjustable parameters

1.2.4. GREEN "Calcs" tab: has most of the calculations; no data entry

1.2.5. YELLOW "Standards" tab: shows various standards; can be edited

1.2.6. GREY tabs: for 3E electric efficiency work with EVT; no WAP entry

1.3. General formatting conventions

1.3.1. Note Cell Border colors, Fill colors, and Font colors

1.3.1.1. BLUE border & font: data entry

1.3.1.2. GREEN fill: Notes and instructions

1.3.1.3. YELLOW fill: Highlights something important

1.3.1.4. ORANGE font, usually with grey fill: these cells are for posting "Installed" values after work is complete, as opposed to "Proposed" values that describe the scope of proposed work

1.3.1.5. Several cells set with Conditional Formatting for error-trapping: RED font or fill: Something's missing

1.3.2. **Red triangles** in upper right of cell: Hover over cell to see Comment (Green triangles in upper left of cell can be ignored)

1.3.3. Some cells have Drop-down arrow to right of cell; select entry from list

1.3.4. Notice PDF buttons on most pages: Saves a PDF of the page(s) to the same folder where the Tool is located.

1.4. How to copy cell data -

1.4.1. **NEVER 'MOVE'** or highlight and drag cells. **NEVER 'CUT & PASTE'!** Doing so will mess up cell references.

1.4.2. 'COPY & Paste' generally is OK. Best to 'Paste VALUES' rather than simply Paste (it preserves the formatting of the target cells).

2. GEN page

2.1. Reminders

- 2.1.1. Project Tool Version: 'Version Date', 'Version #': Use to track versions of tool for each project.
- 2.1.2. Select Occupancy Type
- 2.1.3. Check box if WAP eligible, previous WAP (date in cell H40)
- 2.1.4. Note list of Installation Contractors list: Add name when selected. Project costs are sorted on 'CostSmry' page by CSI Division #, then by Contractor.
- 2.1.5. 'Dwelling Unit Types': Sort all residential units into types according to # bedrooms, square footage, and/or location (for ventilation calculations)
- 2.1.6. '3E Project Scope' entry not needed for WAP work.

3. FuelData page

- 3.1. More data (4 years) is better data, irons out vacancies & inconsistencies
- 3.2. Request as spreadsheet from supplier; then you can Copy and Paste Values
 - 3.2.1. Use Sort button if data not in correct order
 - 3.2.2. Look for gaps! Large number of days between fills / reads
- 3.3. Notice navigation buttons to navigate this page
- 3.4. Analysis section
 - 3.4.1. **NOTICE: Base Multiplier:** Adjusts proportion of annualized usage estimated to be Heating versus Base (typically DHW).
 - 3.4.2. If more than 100 data points for one fuel source, can overflow into Column 2 and check box near cell J154 to include data into overall average.

4. USE page

- 4.1. Organization: Sections for Space Heating, Domestic Hot Water, and Electric
 - 4.1.1. Note again color conventions: Pre-Retrofit (Existing) / Proposed / Installed
 - 4.1.2. Lots of detail described in cell Comments
 - 4.1.3. Note distinction between 'Input' MMBTU, which is the BTU content of the fuel, and 'Output' MMBTU delivered to Space (or faucet, in case of DHW), which adjusts for combustion (AFUE) and Distribution efficiencies.
- 4.2. Data entries
 - 4.2.1. FuelData analysis displayed in cells T21 & T22; can reference if appropriate in Space Heating and DHW (column B)
 - 4.2.2. AFUE, Distribution Efficiency: see Comments

- 4.2.3. Use calculations in cells where appropriate (don't Cut & Paste!)
- 4.2.4. Easy to account for Multiple fuels and Fuel Switching: Estimate % use post-retrofit
- 4.2.5. DHW disagg guides: Note two *different* guides, one at F30:F31, the other at G29:H29. These intended to assist estimating, but will not align with each other.
- 4.2.6. DHW: Overall Usage Reduction: Show 2% for installation of Low-Flow devices, or more if significant reductions in *usage* are expected from DHW improvements
- 4.3. Electrical Disagg
 - 4.3.1. This section used primarily for Heat Gain estimate; close accuracy not needed
 - 4.3.2. However there is one Reality check: Notice PUM plug load
 - 4.3.3. Savings from various retrofits are linked to 'EEC' tab, which is used by 3E (not WAP). For LEEP bulb direct-install, enter number of bulbs in L40.

5. QLOS page

- 5.1. Organization of page
 - 5.1.1. Cell colors; Existing / Proposed / Installed; info in Heading
 - 5.1.2. Make use of Comments and Notes sections in light green-filled cells!
- 5.2. Mechanical Ventilation section
 - 5.2.1. Organization
 - 5.2.1.1. Six Unit Types, as entered on Gen page
 - 5.2.1.2. Three sections: Bath / Kitchen / Whole Unit, PLUS Common Space (box V5:AA10)
 - 5.2.1.3. Note that for User-Controlled Bath & Kitchen fans, Hours of Operation must be entered at Y12:AA13 (grey-green cell color, highlights red if entry is missing)
 - 5.2.2. Data required
 - 5.2.2.1. Enter Existing PER-UNIT data for each Unit Type
 - 5.2.2.2. Entries in Proposed and Installed columns ONLY IF CHANGE from Existing
 - 5.2.2.3. Use 'heat recovery %' to indicate Balanced supply/exhaust
 - 5.2.2.4. If additional ventilation installed, if done in Kitchen, or Bath, can satisfy both Unit and Kitchen requirements
 - 5.2.2.5. Bottom line shows Required Continuous CFM per Unit; cell-color shows red if way off, or yellow if off but within WAP limits

- 5.3. Exposed Surface Analysis section
 - 5.3.1. Surface Description: This outputs elsewhere; follow standard format such as: Type / Description / Area / Tempered Surface % / R-value.
 - 5.3.2. Use formulas to calculate areas & R-values; helps explain where values came (useful in future reviews).
- 5.4. Now press RECONCILE button to adjust Pre-Retro Model to fuel Use tab
 - 5.4.1. Look at Model Factor, Base Temp: Does it make sense?
 - 5.4.2. Note Model Net Annual box (V28:AA33), and EUI Metrics (V16:AA25)
- 5.5. Surfaces: Proposed Retrofit — shows Proposed Delta or CHANGE
 - 5.5.1. Enter target Proposed CFM50 (cell O29); again, use formula referencing Pre-Retrofit CFMpre (cell L29).
 - 5.5.2. Enter R-values ADDED (not final post-retrofit values).
 - 5.5.2.1. Use formulas to calculate R-value of new assembly and deduct from it the Existing R-val
 - 5.5.3. Optional: Show estimated portion of CFM reduction attributable to retrofit work on each Surface. (Doing so increases the savings for that Surface / measure, but reduces general Infiltration measure savings.)
 - 5.5.4. Note SIR column: calculates the screenable cost available to achieve the stipulated Retrofit R-val and CFM Reduction
 - 5.5.4.1. Click check-box near V27 to use WAP fuel pricing (affects check box on all pages).
 - 5.5.5. Note % Total Load column — This is HOURLY load, but proportions can be compared to Pre- column
 - 5.5.5.1. Total Hourly Load calculated for Heating System sizing
- 5.6. Reality check
 - 5.6.1. Look at EUI Metrics: Make sense? BTU Savings / Cost Savings / CFM50 per sq ft

6. SPECS page

- 6.1. Organization: Column A, gray fill, shows Measure Categories
 - 6.1.1. Info about the Measure appears in lighter-gray boxes
 - 6.1.2. Collapse unused sections using "-" sign at *bottom* of Measure category, to the *left* of the row-number bar.
 - 6.1.3. Enlarge or reduce Row height to accomodate text (cells should be set to 'Wrap Text' by default)
- 6.2. Intended use of Notes / Proposed \$ / Item Description columns
 - 6.2.1. Notes column is intended for general description of recommended retrofit

- 6.2.2. Proposed \$ column is for showing overall estimated cost of Measure. Could use rows in this column to detail costs, or enter negative cost if portion of total measure (for example, for a boiler) is to be attributed to a separate Measure (in this example, DHW).
- 6.2.3. Item Description column is for showing further detail about recommended retrofit and the cost breakout in the next columns: Allocation of Proposed Costs (Non-Screenable, Screenable), Fund, Installing Contractor.
- 6.3. What's Non-Screenable vs Screenable
 - 6.3.1. Generally energy-improvement costs up to the SIR threshold can be shown as Screenable.
 - 6.3.1.1. Click check box near U2 for WAP prices.
 - 6.3.2. Again, use formulas to distribute costs
 - 6.3.3. Show costs on separate Rows where EITHER paid by different Funder OR performed by different contractor
 - 6.3.3.1. Fund: Who is paying for this cost
 - 6.3.3.2. Installing Contractor (references list on Gen page)
 - 6.3.4. **WAP Project SIR:** ALL costs of any Measure that WAP is participating in must be included in WAP SIR, whether paid by WAP or not, whether Screenable or Non-Screenable. Enter a 'W' in column K on each row that shows these costs. That cell will highlight in yellow fill with red font — and will do so automatically for any row with WAP as funder.
- 6.4. Finalize button: When costs are all entered, press Finalize button (necessary to update various pivot tables).
- 6.5. Use PDF button, if printout of this page only is needed
- 7. **OUTPUT: OwnerRpt, AuditSmry, CostSmry pages**
 - 7.1. OwnerRpt is intended as overview for Owners and Project Managers.
 - 7.2. AuditSmry is intended for energy specialists.
 - 7.2.1. Note WAP Investment box at D60:F63. Project SIR and WAP cost per unit
 - 7.3. CostSmry shows all Measures and Costs, and who is paying for each. It is sorted by CSI Division, then by Contractor, then by Measure.
- 8. **Other pages**
 - 8.1. No other pages are necessary for WAP use.